Heavy ion Single Event Effects test of the temperature sensor TMP36 from Analog Devices

Test Report

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1 Introduction

This report presents the heavy ion SEL test data on the TMP36 temperature sensor from Analog Devices. This work has been performed in the frame of the SWIFT project.

2 Tested Devices

The tested devices are described in Table 1. The parts have been delidded for testing.

Type	**TMP36**
Manufacturer	Analog Devices
Function	Temperature sensor
Package	5 lead SOT-23
Package marking	N/A
Previous SEE testing	No data available

Table 1: description of the tested devices.

3 Test description

3.1 Irradiation facility

The tests have been performed at the Brookhaven National Laboratories in June 2002. The ion beams used are described in Table 2.

Ion	**Energy (MeV)**	**Average flux (#/cm^2-s)**	**Range (μm)**	**LET (MeVcm^2/mg)**
I-127	320	~5E+04	31	59.7
Au-197	333	~5E+04	28	81.4

Table 2: Ions used at BNL.

3.2 Test set-up

The device can be used for single supply operations from 2.7 to 5.5V. Two power supply conditions have been tested: 3.3V and 5.5V. The highest supply voltage is a worst case for SEL sensitivity. Table 3 gives the supply current at room temperature for these two supply voltages.

Vs (V)	**Is(μA)**
3.3	25
5	28

Table 3: Supply current for the two tested supply voltages at room temperature.

The power supply current was monitored during irradiation. As soon as the current is larger than a given detection threshold, a Single Event Latchup (SEL) is counted. The SEL detection threshold was set to 50 μA.

Different ambient temperatures have also been tested: 25°C, 50°C, 75°C, 80°C. The highest temperature represents a worst case condition for SEL sensitivity. Table 4 shows the output voltages measured for these ambient temperatures.

Output Voltage (V)	Ambient temperature (°C)
0.75	25
1	50
1.2	70
1.25	75
1.3	80

Table 4: Measured output voltages at the different test ambient temperatures
(Vout=750mV at room temperature, output scale factor=10mV/°C).

4 Test results

The test results are presented in Table 5. The part is not sensitive to SEL up to the maximum tested LET of 100 MeVcm^2/mg.

Run #	SN #	Vs (V)	Vout (V)	Icc (uA)	tilt	eff. LET (MeVcm^2/mg)	eff. Fluence (#/cm^2)	SEL	Xsec SEL (cm^2/device)
1	1	3.30	0.74	25	0	59.72	1.00E+07	0	0.00E+00
2	1	5.50	0.77	27.6	0	59.72	1.00E+07	0	0.00E+00
3	1	5.50	0.77	27.6	45	84.46	1.00E+07	0	0.00E+00
4	2	5.50	0.75	29.8	0	59.72	1.00E+07	0	0.00E+00
5	2	5.50	0.75	30	45	84.46	1.00E+07	0	0.00E+00
6	3	5.50	0.75	29.7	0	59.72	1.00E+07	0	0.00E+00
7	3	5.50	0.75	29.7	45	84.46	1.00E+07	0	0.00E+00
8	3	5.50	1	30.5	45	84.46	1.00E+07	0	0.00E+00
9	3	5.50	1	30.5	0	81.43	1.00E+07	0	0.00E+00
10	3	5.50	1.18	32	35	99.41	1.00E+07	0	0.00E+00
11	2	5.50	1.25	34	35	99.41	1.00E+07	0	0.00E+00
12	1	5.50	1.29	32	35	99.41	1.00E+07	0	0.00E+00

Table 5: test results.

5 Conclusions

The test results show that the TMP36 temperature sensor is not sensitive to SEL at the maximum tested LET of 100 MeVcm^2/mg for the worst case supply voltage and ambient temperature. Therefore TMP36 temperature sensor SEL sensitivity is not a concern for space applications.